

APPLYING METEOROLOGY IN POWER SYSTEM PLANNING AND OPERATIONS

Session 1: Meteorology, Climate and the Electric Sector

2017 UVIG FORECASTING WORKSHOP

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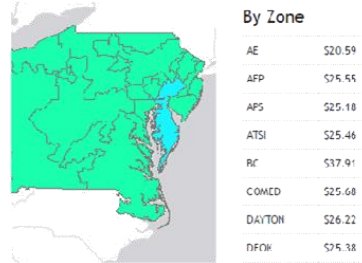
OPERATIONS



Matches supply with demand like...



MARKETS



Energy Market Pricing like...



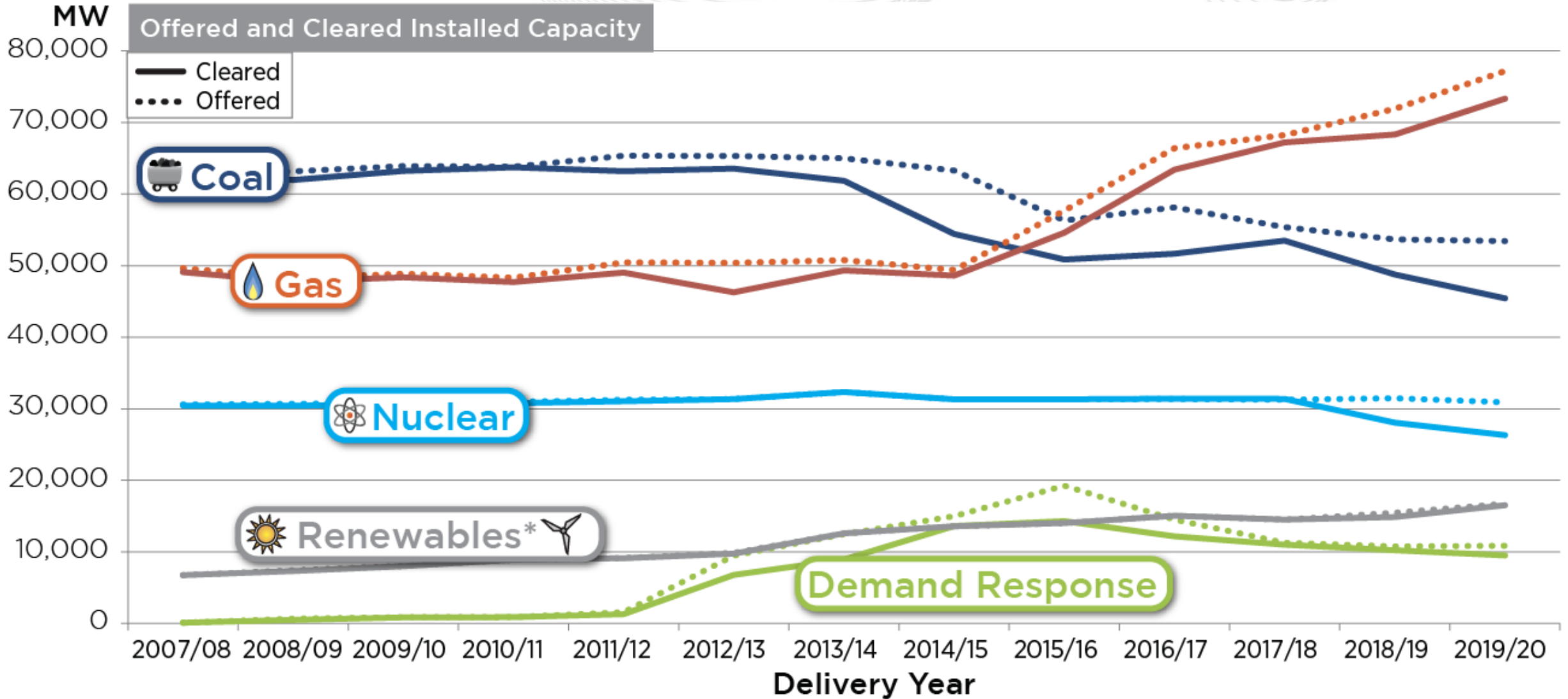
PLANNING



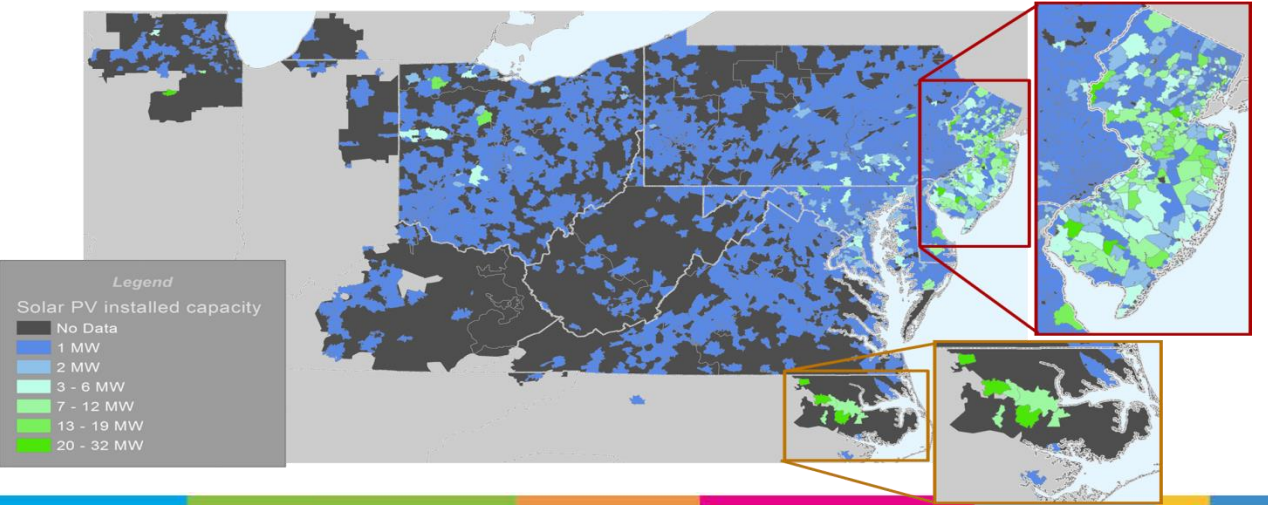
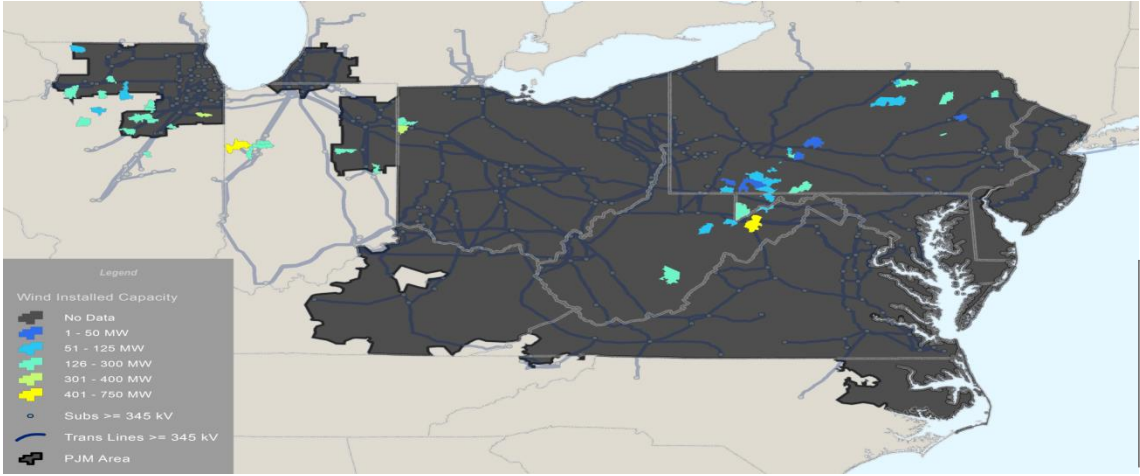
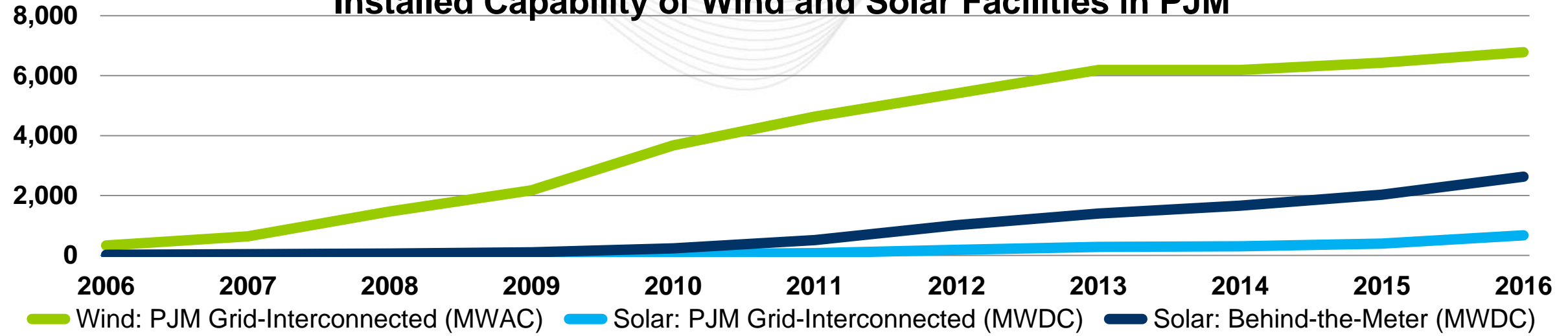
Planning for the future like...



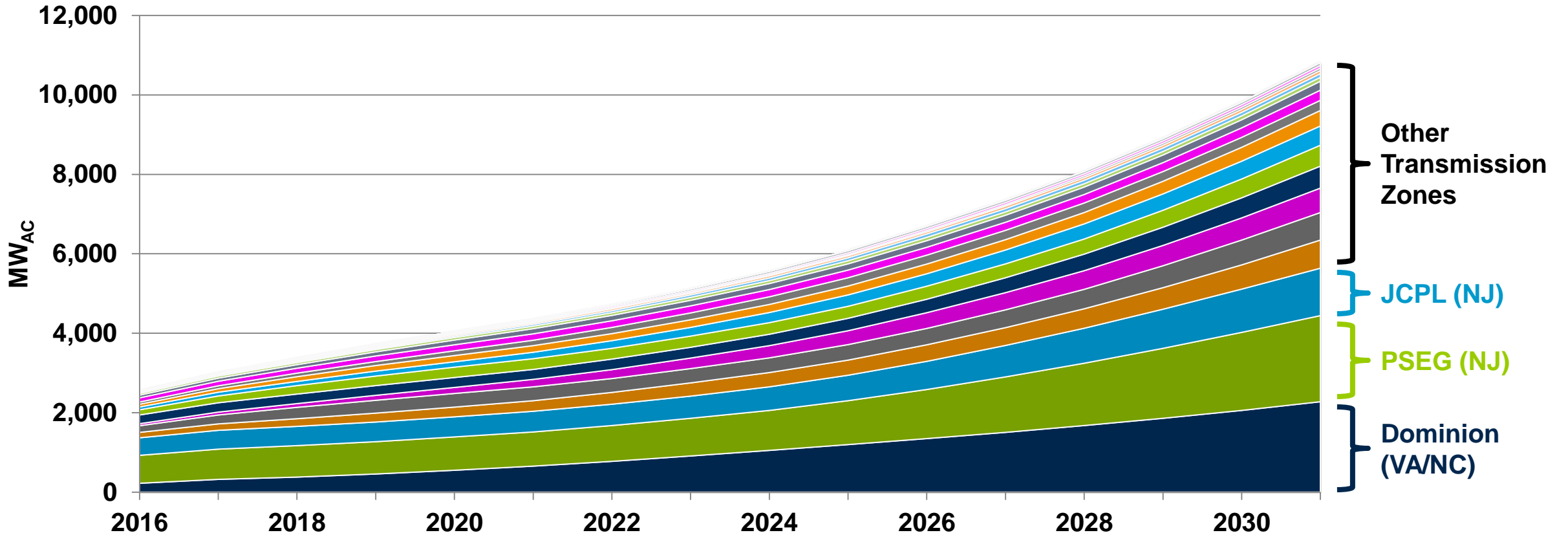
- 61 million people served
- 21% of UD GDP
- 165 GW peak load



Installed Capability of Wind and Solar Facilities in PJM



Cumulative Forecasted Capacity of Behind-the-Meter Solar



Source: IHS Distributed Solar Generation Forecast. More info: <http://www.pjm.com/~media/planning/res-adeq/load-forecast/ihs-pjm-pv-forecast-report.ashx>

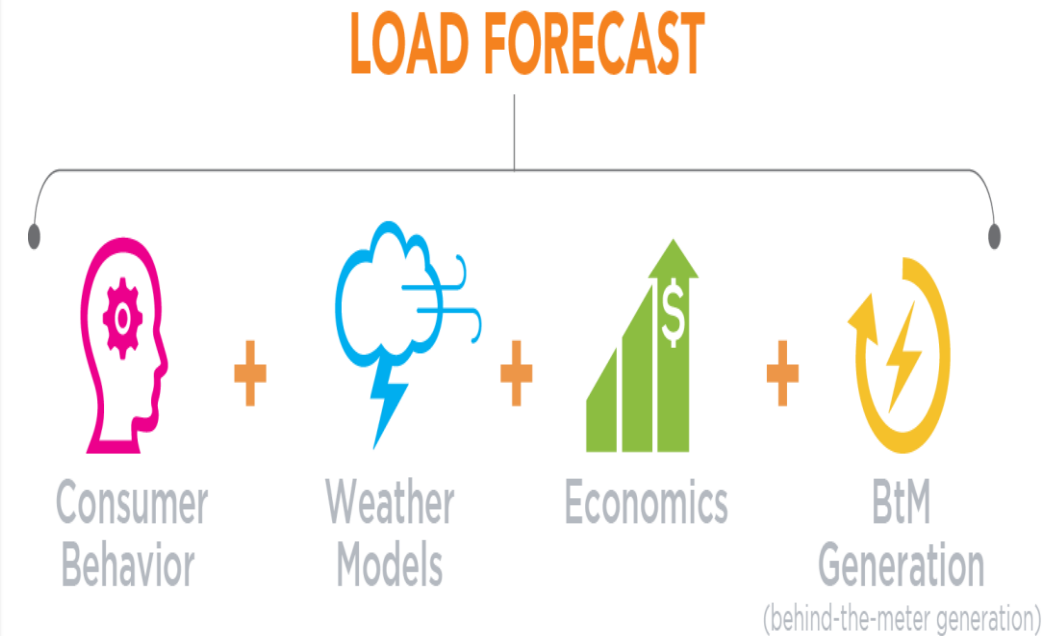
Staff Meteorologist is integral part of Operations:

Forecasting

- Load, Hydro, Wind, Solar and Distributed Solar
- Works with operators on Short-Term Load Forecasts, used for Day-Ahead Unit Commitment, Security Constrained Economic Dispatch, Reserve calculations, Outage approval
- Receives and interprets weather forecasts from vendors, monitors performance
- Provides specialized forecasts for cold weather testing, gas/electric coordination team, etc.

Severe Weather / Real-Time Monitoring

- Monitors, provides situation awareness, and helps operators respond to changing severe weather scenarios (e.g. summer afternoon thunderstorms, tropical storms, etc.)



PJM Initiatives to Integrate Renewables



Operations

- Implemented changes to improve renewable dispatch / control
- Interchange Scheduling – compliant with FERC Order 764
- Implemented wind, grid-connected solar and BTM solar forecasts

Transmission Planning

- Light load criteria implemented to improve grid reliability
- Expansion planning considers public policy impacts (i.e., RPS)
- Enhanced standards for new inverter-based resources

Wind and Solar Forecasting

Include meteorological data as inputs into forecast

- Wind speed and direction
- Solar irradiance and temperature

Calculate Lost Opportunity Cost using back-cast

- Uses meteorological data measured at each farm
- Real-time meteorological data must be provided for farm to receive LOC

Evaluating Potential Grid Impacts

- PJM Renewable Integration Study – assessed grid impacts

Markets

- Demand Response / Price Responsive Demand improves operational flexibility
- Frequency Regulation – “pay for performance” rewards better performing resources (i.e. storage)
- Back-casted Lost Opportunity Cost compensates curtailed wind farms

Meteorological data critical for developer site selection, grid operations and market settlements

- Reliability Pricing Model (Capacity Market) – Permits aggregation of resources
- Technology
 - Wind + Battery
 - Solar + Battery
 - Dynamic Ratings
- PJM Evolving Resource Mix and Grid Reliability
 - <http://www.pjm.com/~media/library/reports-notice/special-reports/20170330-pjms-evolving-resource-mix-and-system-reliability.ashx>
- Grid Resilience

